PATENT SPECIFICATION 725,364

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COMPLETE SPECIFICATION.

Planetary Speed-Reduction Gearing.

We, ROTARY HOES LIMITED, a British Company, of Station Road, East Horndon, Essex, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement :—

The invention relates to a planetary gearing for selectively driving a power output shaft at unit, or a reduced, ratio from an aligned power input shaft, and the object of the invention is an improved reduction gearing of this kind which, although not limited in this respect, is particularly adapted for incorporation in certain kinds of tractor hereinafter defined.

According to the invention there is a selectively slidable gear wheel, rotatively fast with the output shaft, which in one extreme position meshes an internally-toothed gear wheel concentrically fast with the planet wheel carrier whereby to provide a reduced ratio drive from the sun wheel, fast with the input shaft, through planet wheels meshing a stationary internally-toothed ring, and which in the other extreme position has a dog-clutch engagement with the sun wheel whereby to provide a direct drive.

For enabling the gearing of the invention to be made so as to be compact and robust, the planet wheel carrier body can be rotatively supported from the sun wheel and have, on one axial side, a concentric axial flange with a concentric ring of axial bores in each of which one of the planet wheels is housed, the bores being of a sufficiently greater diameter than the radial thickness of the flange for opposite sides of the planet wheels to extend beyond the inner and outer peripheries of the flange for meshing the internally-toothed ring and the sun wheel, and the bores extending, with the same or a different diameter, through the body to provide housings for bearings for the adjacent one ends of the planet wheels, the other ends of the latter being supported in bearings housed in aligned bores of a cover plate which is secured to the unattached end of the flange. In this way it is possible for the ends of the planet wheels to be plain and axially extended for co-action in the bearings, and these extended ends can be of a diameter which is approximately that of the dedendum circle of the wheel—thereby providing a more robust support for the planet wheels than if, in accordance with known practice, they were journalled on stub shafts fast with the carrier.

The planetary gearing is particularly adapted for incorporation in a tractor of the kind in which the drive, from a change-speed gearing of the tractor to the axle of a driven ground-engaging wheel, is through a pair of aligned transmission shafts with their adjacent ends splined and interconnected by an internally-splined sleeve. For this purpose, and according to a further feature of the invention, the planetary gearing additionally includes an output shaft portion on one end of which the slidable gear wheel is splined and of which the other end has a splined bore for engaging, after removal from the tractor of the splined sleeve, the splines of the one of the splined shafts which is connected to drive the axle of the ground-engaging wheel. Thus, the planetary gearing of the invention can be readily incorporated by substituting it, and the output shaft portion, for the splined sleeve of a tractor of the kind mentioned for providing it with a specially reduced ratio drive for certain operational uses.

When the tractor additionally has its gear casing formed in two portions which abut, and are detachably interconnected (e.g. by bolted flanges), in the region normally occupied by the splined sleeve, the stationary

internally-toothed ring of the planetary gearing is, according to a still further feature of the invention, made fast with a plate which is parallel to the plane of the ring and is to be clamped between the gear casing parts for locating the planetary gearing within the tractor gear casing.

A tractor of this last-mentioned kind is commonly provided at one side of the gear casing with a detachable plate in which is journalled a control shaft for engaging, and disengaging, a drive for a power take-off shaft of the tractor, and according to yet another feature it can be arranged for the selectively slidable gear wheel of the planetary gearing of the invention to be in the region of this detachable plate and for the latter to be substituted by one additionally supporting a control shaft with, at its inner end, a selector means for sliding the gear wheel and, at its outer end, a manual control (e.g. a lever) for effecting the changes of ratio provided by the planetary gearing.

In the accompanying drawings is illustrated an embodiment of the planetary gearing of the invention and its application to a tractor having all of the features above mentioned. In these drawings :—

Figure 1 is a side elevation, with part of the near side rear wheel broken away, of the tractor as modified by the addition of the planetary gearing ;

Figure 2 is a fragmentary longitudinal section of an unmodified tractor gear casing to a larger scale and showing the normal splined sleeve interconnection of the aligned shafts of the unmodified tractor ;

Figure 3 is a view which is similar to Figure 2 but showing the planetary gearing of the invention substituted for the splined sleeve ; and

Figure 4 is an exploded, isometric view of some of the components of the planetary gearing shown in Figure 3.

Referring to Figure 1, the tractor gear casing is formed in two portions 11, 12 with outwardly-directed flanges 13 on their adjacent ends by which they are secured together by a ring of nuts and bolts 14 (see Figures 2 and 3). The portion 12, in known manner, has a detachable plate in the position indicated by 15 in which is journalled a shaft (not shown) having, at its outer end, a substantially radial handle 17 by which a means, at its inner end and not shown, can operate to engage or disengage a drive to a power take-off shaft (not shown).

From Figure 2 it will be seen that the rear end of the casing portion 11 has a transverse web 18 in which is supported a roller bearing 19 for a shaft 20 driven from the tractor normal change-speed gearing—for which latter a control lever is shown at 11*a* in Figure 1. The tail-end of the shaft 20 is spaced axially from a shaft 21 by which the drive is taken to the back axle, and the adjacent ends of the shafts 20 and 21 are externally splined and, in the unmodified tractor, interconnected by an internally splined sleeve 22—this construction enabling the casing portions 11, 12 to be separated easily without involving a previous disassembling of the transmission.

Referring now to Figure 3, the planetary gearing of the invention, which is shown substituted for the splined sleeve 22, comprises a sun-wheel 23 mounted on the splined end of the shaft 20 (which is regarded as the input shaft of the planetary gearing), and a slidable gear wheel 24 mounted on splines at the front end of a shaft 25 which, at the rear, has an enlarged portion 26 with an internally-splined bore for providing the connection to the shaft 21. The planet wheel carrier is formed of three separate annular members 27, 28 and 29 held together by a ring of bolts 29*a*, the members 27 and 28 being journalled on plain portions at the ends of the sun-wheel.

In the construction shown there are five planet wheels 30, supported in the carrier as hereinafter described, which mesh both the sun-wheel and a stationary internally-toothed ring 31. The latter, in the illustrated application of the planetary gearing, is made fast (e.g. by welding or by riveting, as shown) with a thin plate 32 to be clamped between the gear casing flanges 13, 13 by the nuts and bolts 14.

The sun-wheel 23 and slidable gear wheel 24 have co-acting dogs 33, 34 respectively, at their adjacent ends, and the slidable gear wheel has an external ring of teeth 35 for co-action with an internal ring of teeth 36 of the planet wheel carrier member 29. Thus, when the gear wheel 24 is slid in the manner hereinafter described to one extreme position, the dog teeth 33, 34 engage to provide a direct drive from the shaft 20 to the shaft 21 and when it is slid to its opposite extreme position the toothed rings 35 and 36 engage to provide a drive of reduced ratio.

For sliding the gear wheel 24 there is a selector rod 40 having a fork 41 engaging an annular groove 42 of the wheel and slidably mounted in bores in arms 43, 43 of a plate 15*a* (see Fig. 3) which is substituted for the normal plate at 15. The selector rod has fast with it a block with a pair of cheeks 45, 45 between which is engaged an end 46 of a radial arm of a shaft 47 which, in the example illustrated, is journalled in the plate 15*a* and provided with an external operating lever 48. A spring-pressed pawl 42*a* coacts with notches 42*b* in the rod for lightly locating the latter in its alternative positions.

Referring now to Figure 4, it will be seen that the member 27 of the planet wheel carrier has a concentric axial flange which has been formed into individual axial extensions

50, 50 by a concentric ring of axial bores which break through its circumferential walls. These bores provide housings for the planet wheels 30, and the latter have recessed ends, of a diameter which is slightly less than that of their dedendum circles, by which they are rotatively supported through roller bearings 51, as shown in Figure 3, in concentric axial bores 52, 52 in the radial portion of the member 27.

The planet wheel carrier member 28, which has a rim 53 spigotally to receive the extensions 50 and acts as a cover plate for the planet wheels, has corresponding bores 52*a*, 52*a* for supporting the opposite ends of the planet wheels through roller bearings 51*a*. The member 28 also has a ring of intermediate holes 60, 60 through which, and through aligned holes 61 of the planet wheel carrier member 29, the bolts 29*a* are passed into screw-threaded holes 62, 62 in the extensions 50, the radial flange of the member 29 being spigotally received within another rim, 63, of the member 28. In this way not only are the planet wheels conveniently housed but it is possible for them to be given a much larger bearing area than if they were journalled on stub axles fast with the carrier.

It will be seen that for installing the planetary reduction gearing in the tractor, the principal operations are to open up the gear casing and to substitute the said gearing for the internally splined sleeve; also that the gear casing of the tractor is only increased in length by an amount equal to the thickness of the plate 32 (which can be quite thin) after the planetary gearing has been installed.

While the planetary gearing has been described principally with reference to its application to a tractor, of a particular kind, it will of course be understood that it has other applications.

What we claim is :—

1. A planetary gearing for selectively driving a power output shaft at unit, or a reduced, ratio from an aligned power input shaft, in which there is a selectively slidable gear wheel, rotatively fast with the output shaft, which in one extreme position meshes an internally-toothed gear wheel concentrically fast with the planet wheel carrier whereby to provide a reduced ratio drive from the sun-wheel, fast with the input shaft, through planet wheels meshing a stationary internally-toothed ring, and which in the other extreme position has a dog-clutch engagement with the sun-wheel whereby to provide a direct drive.

2. A planetary gearing, according to Claim 1, in which the planet wheel carrier body is rotatively supported from the sun-wheel and has, on one axial side, a concentric axial flange with a concentric ring of axial bores in each of which one of the planet wheels is housed, the bores being of a sufficiently greater diameter than the radial thickness of the flange for opposite sides of the planet wheels to extend beyond the inner and outer peripheries of the flange for meshing the internally-toothed ring and the sun-wheel, and the bores extending, with the same or a different diameter, through the body to provide housings for bearings for the adjacent one ends of the planet wheels, the other ends of the latter being supported in bearings housed in aligned bores of a cover plate which is secured to the unattached end of the flange.

3. A planetary gearing, according to Claim 2, in which the planet wheels have plain, axially-extended ends, for co-action with the bearings, of a diameter which is approximately that of their dedendum circle.

4. A planetary gearing, according to any preceding claim and for incorporation in a tractor in which the drive, from a change-speed gearing of the tractor to the axle of a driven ground-engaging wheel, is through a pair of aligned transmission shafts with their adjacent ends splined and interconnected by an internally-splined sleeve, in which the planetary gearing additionally includes an output shaft portion on one end of which the slidable gear wheel is splined and of which the other end has a splined bore for engaging, after removal from the tractor of the splined sleeve, the splines of the one of the splined shafts which is connected to drive the axle of the ground-engaging wheel.

5. A planetary gearing, according to Claim 4 and in the case when the tractor additionally has its gear casing formed in two portions which abut, and are detachably interconnected, in the region normally occupied by the splined sleeve, in which the stationary internally-toothed ring of the planetary gearing is made fast with a plate which is parallel to the plane of the ring and is to be clamped between the gear casing parts for locating the planetary gearing within the tractor gear casing.

6. A planetary gearing, according to Claim 4 or 5 and in the case where the tractor is provided at one side of the gear casing with a detachable plate in which is journalled a control shaft for engaging and disengaging a drive for a power take-off shaft, in which it is arranged for the selectively slidable gear wheel of the planetary gearing to be in the region of this detachable plate and for the latter to be substituted by one additionally supporting a control shaft with, at its inner end, a selector means for sliding the gear wheel and, at its outer end, a manual control for effecting the changes of ratio provided by the planetary gearing.

7. A planetary gearing substantially as described with reference to Figures 1, 3 and 4 of the accompanying drawings.

8. A planetary gearing and tractor combination substantially as described with reference to Figures 1, 3 and 4 of the accompanying drawings.

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PROVISIONAL SPECIFICATION.

Planetary Speed-Reduction Gearing.

We, ROTARY HOES LIMITED, a British Company, of Station Road, East Horndon, Essex, do hereby declare this invention to be described in the following statement:—

The invention relates to a planetary gearing for selectively driving a power output shaft at unit, or a reduced, ratio from an aligned power input shaft, and the object of the invention is an improved reduction gearing of this kind which, although not limited in this respect, is particularly adapted for incorporation in certain kinds of tractor hereinafter defined.

According to the invention there is a selectively slidable gear wheel, rotatively fast with the output shaft, which in one extreme position meshes an internally-toothed gear wheel concentrically fast with the planet wheel carrier whereby to provide a reduced ratio drive from the sun wheel, fast with the input shaft, through planet wheels meshing a stationary internally-toothed ring, and which in the other extreme position has a dog-clutch engagement with the sun wheel whereby to provide a direct drive.

For enabling the gearing of the invention to be made so as to be compact and robust, the planet wheel carrier body can be rotatively supported from the sun wheel and have, on one axial side, a concentric axial flange with a concentric ring of axial bores in each of which one of the planet wheels is housed, the bores being of a sufficiently greater diameter than the radial thickness of the flange for opposite sides of the planet wheels to extend beyond the inner and outer peripheries of the flange for meshing the internally-toothed ring and the sun wheel, and the bores extending through the body to provide housings for bearings for the adjacent ends of the planet wheels, the other ends of the latter being supported in bearings housed in aligned bores of a cover plate which is secured to the unattached end of the flange. In this way it is possible for the ends of the planet wheels to be axially extended for co-action in the bearings, and these extended ends can be of a diameter which is approximately that of the dedendum circle of the wheel—thereby providing a more robust support for the planet wheels than if, in accordance with known practice, they were journalled on stub shafts fast with the carrier.

The planetary gearing is particularly adapted for incorporation in a tractor of the kind in which the drive, from a change-speed gearing of the tractor to the axle of a driven ground-engaging wheel, is through a pair of aligned transmission shafts with their adjacent ends splined and interconnected by an internally-splined sleeve. For this purpose, and according to a further feature of the invention, the planetary gearing additionally includes an output shaft portion on one end of which the slidable gear wheel is splined and of which the other end has a splined bore for engaging, after removal from the tractor of the splined sleeve, the splines of the one of the splined shafts which is connected to drive the axle of the ground-engaging wheel. Thus, the planetary gearing of the invention can be readily incorporated by substituting it, and the output shaft portion, for the splined sleeve of a tractor of the kind mentioned for providing it with a specially reduced ratio drive for certain operational uses.

When the tractor additionally has its gear casing formed in two portions which abut, and are interconnected (e.g. by bolted flanges), in the region normally occupied by the splined sleeve, the stationary internally-toothed ring of the planetary gearing is, according to a still further feature of the invention, made fast with a plate which is parallel to the plane of the ring and is to be clamped between the gear casing parts for locating the planetary gearing within the tractor gear casing.

A tractor of this last-mentioned kind is commonly provided at one side of the gear casing with a detachable plate in which is journalled a control shaft for engaging, and disengaging, a drive for a power take-off shaft of the tractor, and according to yet another feature it can be arranged for the selectively slidable gear wheel of the planetary gearing of the invention to be in the region of this detachable plate and for the latter also to support a control shaft with, at its inner end, a selector means for sliding the gear wheel and, at its outer end, a manual control (e.g. a lever) for effecting the changes of ratio provided by the planetary gearing.

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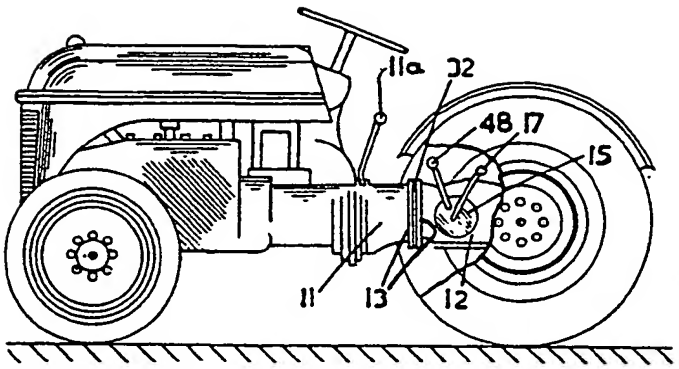

FIG.1

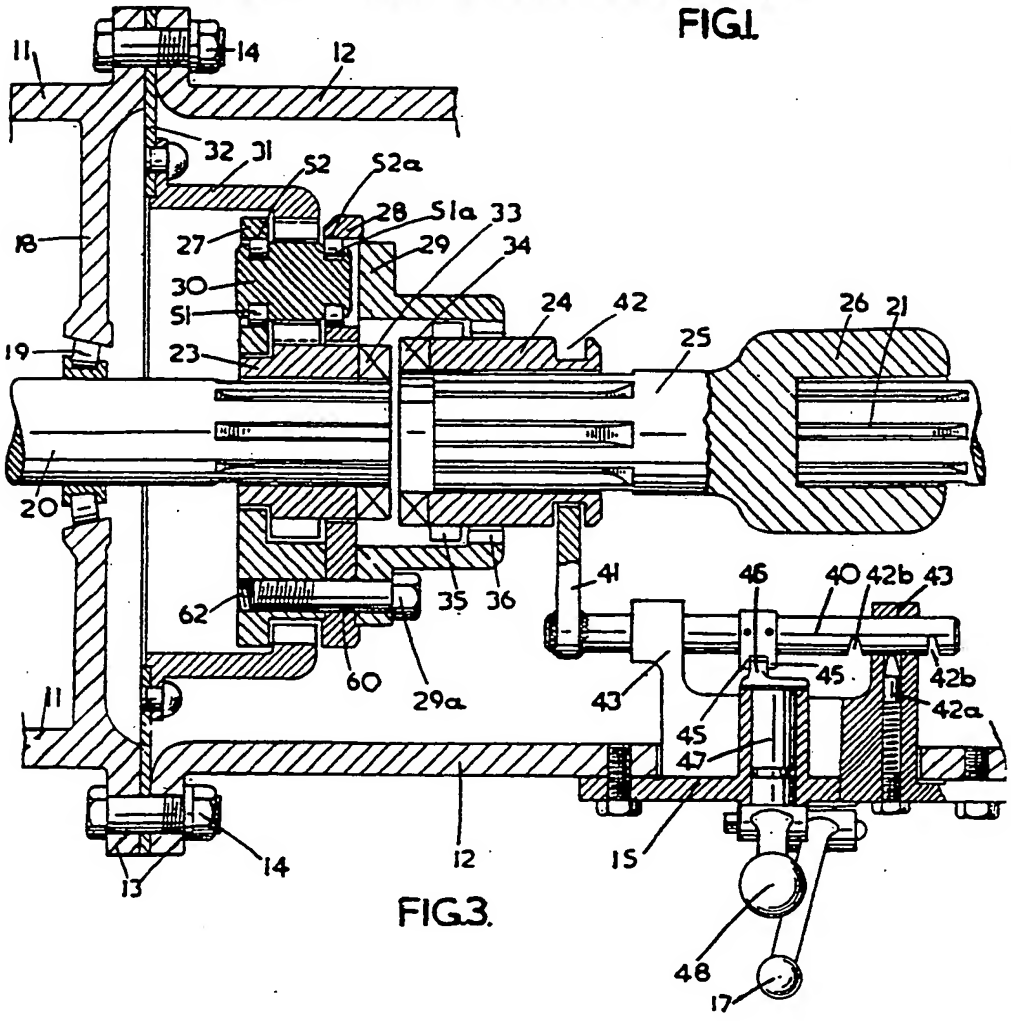

FIG.3.

725,364 COMPLETE SPECIFICATION

2 SHEETS

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SHEETS 1 & 2

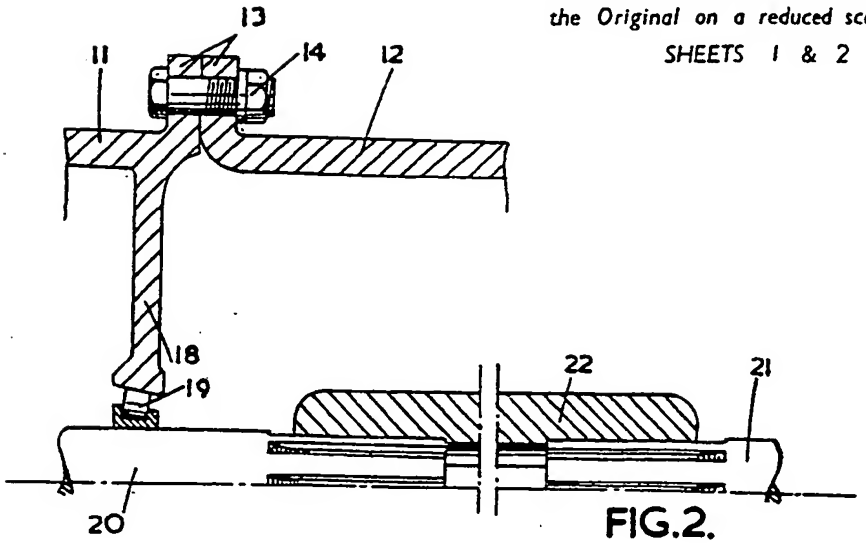


FIG.2.

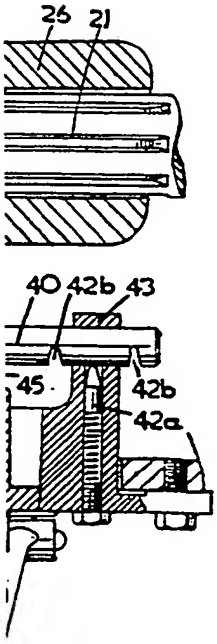
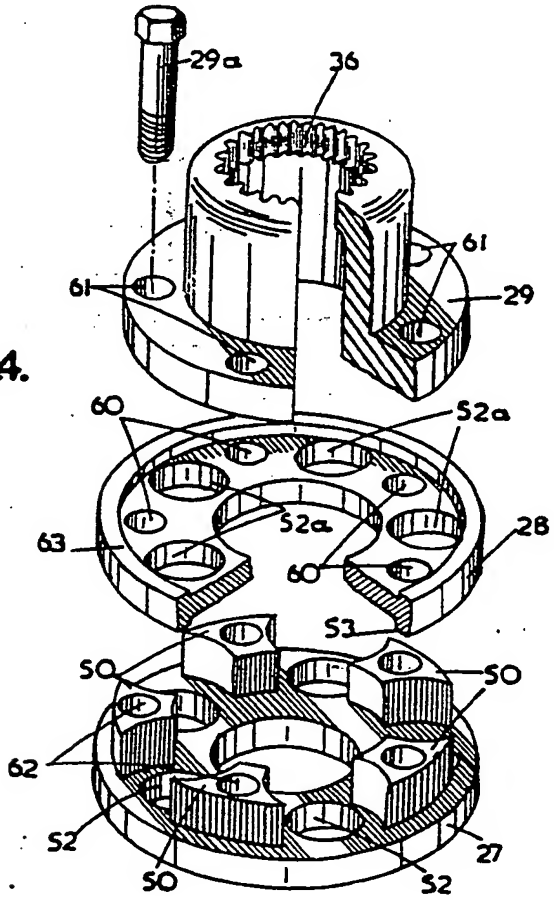


FIG4.



725,364 COMPLETE SPECIFICATION

2 SHEETS

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SHEETS 1 & 2

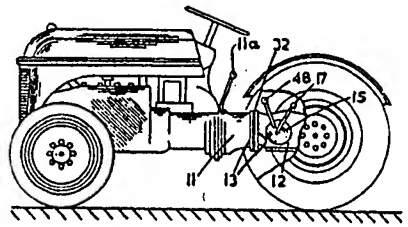

FIG.1

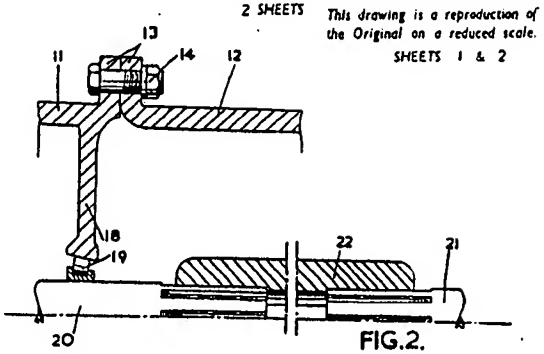

FIG.2.

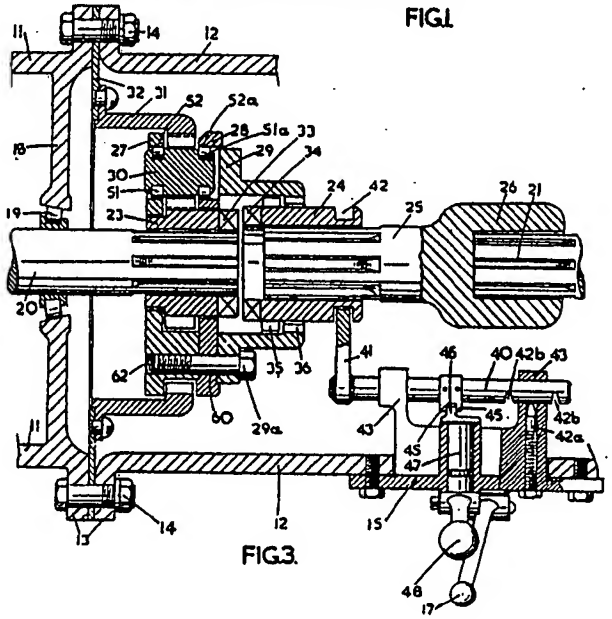

FIG.3.

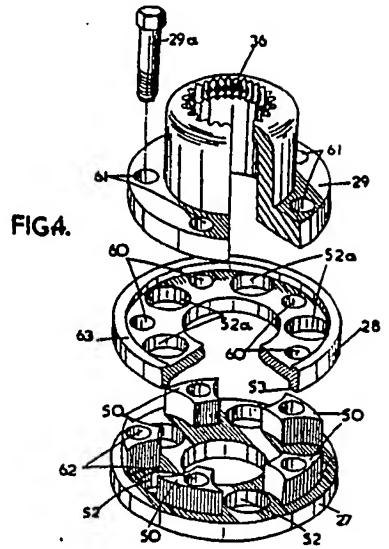

FIG.4.